Keeping it Green

December 2011

AUSTRALIAN GOLF ENVIRONMENTAL INITIATIVE NEWSLETTER

EDITORIAL

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If you have any editorial or photos you would like to submit for publication in Keeping it Green, please contact AGCSA environmental agronomist John Geary jgeary@agcsa.com.au or phone (03) 9548 8600

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AGCSA Board and Staff wish everyone a merry Christmas and a happy new year.

AGCSA

BICHENO GOLF CLUB – Managing Coastal Vegetation Removal and Dune Stabilisation

Bicheno, Tasmania

By Neil Crafter and Paul Mogford, Principal, Crafter + Mogford Golf Strategies golf course architecture

INTRODUCTION

The Bicheno Golf Club is located some 4.5 kilometres north of the town of Bicheno on Tasmania's eastern coast. It has an existing 9 hole course that is set on the coastal side of the Apsley Ranges and immediately to the east of the Tasman Highway. At its closest point, the current golf course lies around 300m inland from the waters of Maclean Bay.

It is proposed to extend the existing golf course by the provision of an additional nine holes on land adjoining the existing golf course as part of a small-scale sub-division development. Some of this land includes coastal dunes fronting Maclean Bay.

This article briefly discusses the impact of both the construction of these new holes and their on-going maintenance on the stability of these coastal sand dunes.

GOLF & COASTAL DUNES

Golf was first developed in Scotland on the coastal links, the sandy dunesland linking the ocean with the arable agricultural land further inland. Accordingly, the game and its history is inextricably linked with sandy coastal land and the links of Scottish coastal towns such as Musselburgh, St Andrews, Carnoustie, Elie and Dornoch are all home to venerable ancient links courses. As golf moved out of Scotland, inland courses were developed. However, the game has consistently thrived on the sandy coastal dunes where the coastal breezes impact on the play of the course. The proof of this is the development of Barnbougle Dunes and now Lost Farm at Bridport, where a section of coastal dunes has supported this thriving public golf course complex, in both an economically and environmentally sustainable manner. The opportunity that this gives the Bicheno Golf Club to expand their existing 9 hole course into the adjacent coastal dunes in a similar sustainable manner to that achieved at Bridport is considered significant for the ongoing success of golf in this small community.

DESCRIPTION OF THE PROPOSAL

It is proposed to construct an additional 9 golf holes on land to the north and east of the existing golf course. This land is well suited to golf, comprising predominantly sandy soils, and with approximately 900m length of coastal dunes. The coastal dunes rise to a typical height of around 6 to 7m AHD, with the higher dune peaks from 10 to 14m, and are predominantly vegetated by Coastal Wattle (Acacia sophorae), an invasive species that has progressively taken over the dunes over the last 50 years. Immediately behind the dunes lies a series of wetlands and low-lying areas that are subject to periodical inundation from heavy rain events, sitting at a typical level of around 3 to 4m AHD, with plant communities that include Melaleuca ericafolia and Lepidosperma longitudinale. Moving inland from behind the coastal dune, the land gradually rises up to around 7m AHD at the western extent of the new golf holes.

GOLF COURSE DESIGN PHILOSOPHY

The overarching philosophy in the design of the extension to the Bicheno Golf Club is to utilise the natural features of the land and to minimise any earth-shaping, so as to create a very natural appearing 'minimalist' golf course. The wonderful coastal dunes are a striking feature of the site and it is intended that the holes within the dunes will become the feature holes of the course. The new holes will have a good variety of length, play direction, dogleg direction and landscape setting, with some holes having wetland settings, upland settings and coastal dune settings, creating a challenging and complementary nine holes to the existing course.

VEGETATION MANAGEMENT & DUNE STABILITY

Coastal wattle

In the proposal all or part of 4 new golf holes are located in the coastal dunes, which have been significantly overrun by the Coastal Wattle (Acacia sophorae) over a number of years. This species is prevalent across much of the coastal regions of south-eastern Australia, including Tasmania. A research paper entitled "Effects of Invasion by the indigenous shrub Acacia sophorae on plant composition of coastal grasslands in south-eastern Australia" by Costello,

Lunt and Williams (Biological Conservation 96 (2000) 113-121) discusses that a number of qualitative accounts have been published on indigenous species that are often considered "out of balance environmental weeds" in certain areas in south-eastern Australia, including, amongst others, Acacia sophorae. The paper describes Acacia sophorae as "a spreading shrub which is indigenous to the coastal belt of south-eastern Australia. It is a pioneer species which colonises coastal sand dunes in South Australia, Victoria, Tasmania, New South Wales and southern Queensland. In recent decades, A. Sophorae has invaded a variety of near-coastal ecosystems including heathlands and woodlands." The paper describes the significant impact this plant is having on coastal grassland environments as well, discussing the impact on a coastal heathland site near Portland in Victoria, where the coastal wattle expanded rapidly, causing substantial reductions in heathland plant diversity.

Additionally, changes in prevailing ecological management and disturbance regimes can influence the expansion of Acacia sophorae, especially changes in grazing regimes. The plant is palatable to cattle and there is evidence that the exclusion of grazing stock from a property can lead to rapid invasion, as indicated in the photograph below from the paper which shows the extent of Acacia stands in ungrazed paddocks adjacent to grazed paddocks.

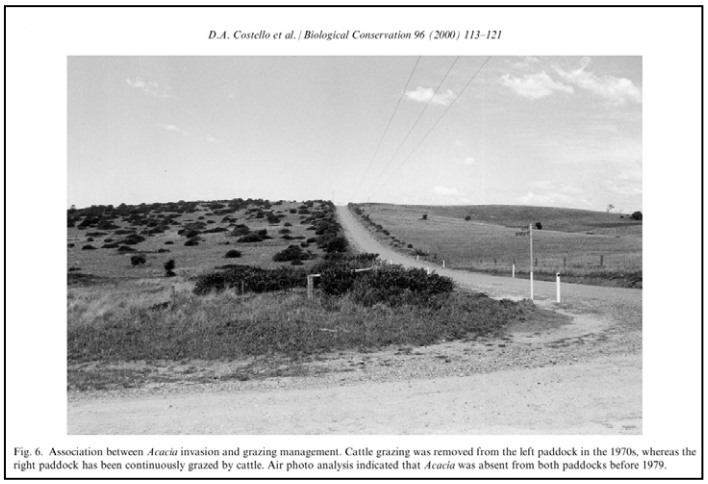


Photo #1: Photograph showing the impact of grazing on Acacia invasion, the right paddock has been continuously grazed, while grazing in the left paddock was stopped in the 1970s. The difference is stark.

The historical extent of change in the nature of the dune vegetation along this section of coastal dunes at Bicheno can be seen in Figure 1 on the attached A3 sheet, where historical aerial photography has been obtained and compared with a current aerial of the dunes. Photographs of the coastal section of the site from 1949, 1976 and 1985 have been compared with a recent aerial taken in 2008. The comparison clearly depicts the infiltration over time of Acacia sophorae into these sand dunes which has displaced

Photo #2: View at the southern end of the site's coastal dunes looking towards the south and Bicheno. Extent of Coastal Wattle infiltration can be seen. Where clearings have been made, low dune plants like Knobby Club-rush can grow (in the foreground at bottom left)

Photo #3: View from near the location of the proposed 13th green looking north along the coast. Apart from areas that have been cleared, Coastal Wattle has taken over the dunes. Low scale dune plants can populate the cleared areas.

many small scale dune species that have been reduced to small pocket populations or have been totally eliminated from this stretch of dunes. The 1949 aerial shows the dunes as being predominantly raw sand with little dune vegetation. By 1976 coastal wattle had colonized the central section of the dunes adjacent to the wetland, and by 1985 this colony had expanded north and south. By 2008 the entire stretch of dunes was effectively heavily colonized by coastal wattle.

LAND MANAGEMENT REGIME AS A GOLF COURSE

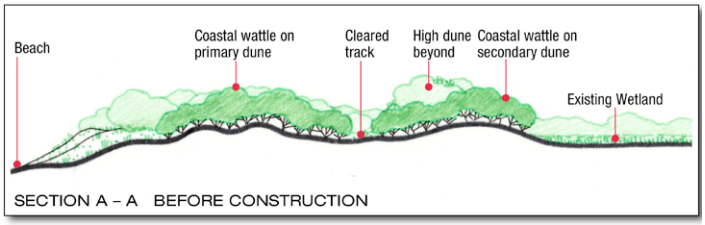
The subject site is not currently grazed, and has not been grazed for many years. Given the ecological and erosion impacts on the dunes from grazing, this practice is not to be encouraged in coastal areas. Accordingly, the extension of the golf course into the coastal dunes provides a mechanism to establish a Land Management Regime that would remove significant areas of the "out of balance environmental weed" that is Acacia sophorae, control its ongoing extent, and actively increase the number and extent of otherwise vulnerable low indigenous dunes plants, providing distinct habitat for various fauna (that are unable to inhabit the coastal wattle areas) in the process. Such a Land Management Regime for the extended golf course would manage and control the environmental weeds on the site whilst ensuring dune stability. If a golf course was not constructed on the site it is most likely that the current situation with the dunes overrun by coastal wattle would continue unabated.

CONSTRUCTION METHODOLOGY FOR DUNE STABILITY

A construction methodology to ensure dune stability is proposed, based upon past experience of dealing with infestations of coastal wattle at other golf courses built on coastal sand dunes, such as Barnbougle Dunes at Bridport, Tasmania, and 13th Beach at Barwon Heads, Victoria.

The Construction Methodology is outlined as follows:

- Ensure that no more than one hole within the coastal dunes is cleared for construction at any one time. Once a hole has been hydroseeded another dunes hole can commence clearing operations. This minimizes the area of dunes possibly susceptible to erosion at any one time;
- Mark clearing lines on site using stakes and surveyor's flagging tape;
- Retain coastal wattle on the ocean side of the primary dune to act as primary barrier for storm and wind erosion;
- Removal of individual bushes of Acacia sophorae using a small excavator with a claw bucket. Each bush is to be pulled out with as much of its roots as possible. Sand to be shaken off the roots back into the hole;
- Removed bushes to be stockpiled, then mulched. Mulch to be spread over areas to be replanted in dunes grasses;
- Any small dunes plants within the coastal wattle are to be carefully dug up by excavator bucket and transplanted at the edges of the golf holes;
- No significant earthworks to take place within the cleared hole corridor apart from some minor levelling for tees, minor excavation for bunkers, and minor reshaping of greens. Fairways to have their existing small scale undulations retained post clearing with the use of a bunker raking machine to smooth these fine contours;
- Install irrigation system. Minor trenching approximately 600mm in depth is required for this installation;
- Following irrigation system installation and commissioning, all golf features are to be fine finished in preparation for hydroseeding;
- Hydroseed golf features to be turfed with heavy hydromulch containing seed, fertilizer and tackifier. Turfgrass to be a blend of fescues (Festuca sp.). Hydromulch layer to prevent wind erosion during grass germination. The erection of protective wind fences (shade cloth) in particularly exposed locations would be utilized as and if required;
- Plant dunes grasses and low plant species into the perimeters of the golf holes, into mulched areas. Mulch to be made from removed coastal wattle plants, with mulch assisting the prevention of wind erosion until dunes grasses and other species mature;
- Establish turfgrass and grow-in with mowing, fertilizing and top-dressing as required;
- Open holes for play following successful completion of grow-in. A typical area of one of the coastal dunes golf holes is examined in Figure 1 and cross-sections from before and after construction have been prepared to depict the primary aspects of this methodology.



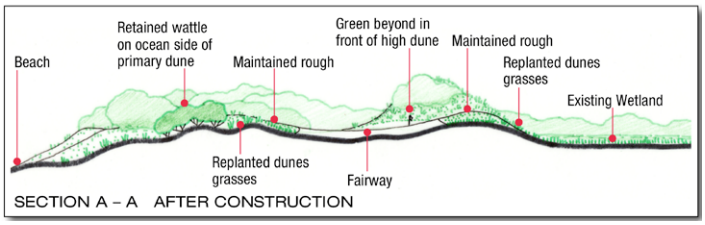


Figure 1: Typical Cross –sections before & after construction through Hole 11

POST CONSTRUCTION COASTAL WATTLE CONTROL & DUNE STABILITY

Following construction, regular maintenance regimes will be put in place to monitor the spread of the Coastal Wattle and remove any infestations in non-desired areas. Dunes within the golf course would also have their stability monitored and any 'blow-outs' or other erosion points would be remediated to maintain stability.

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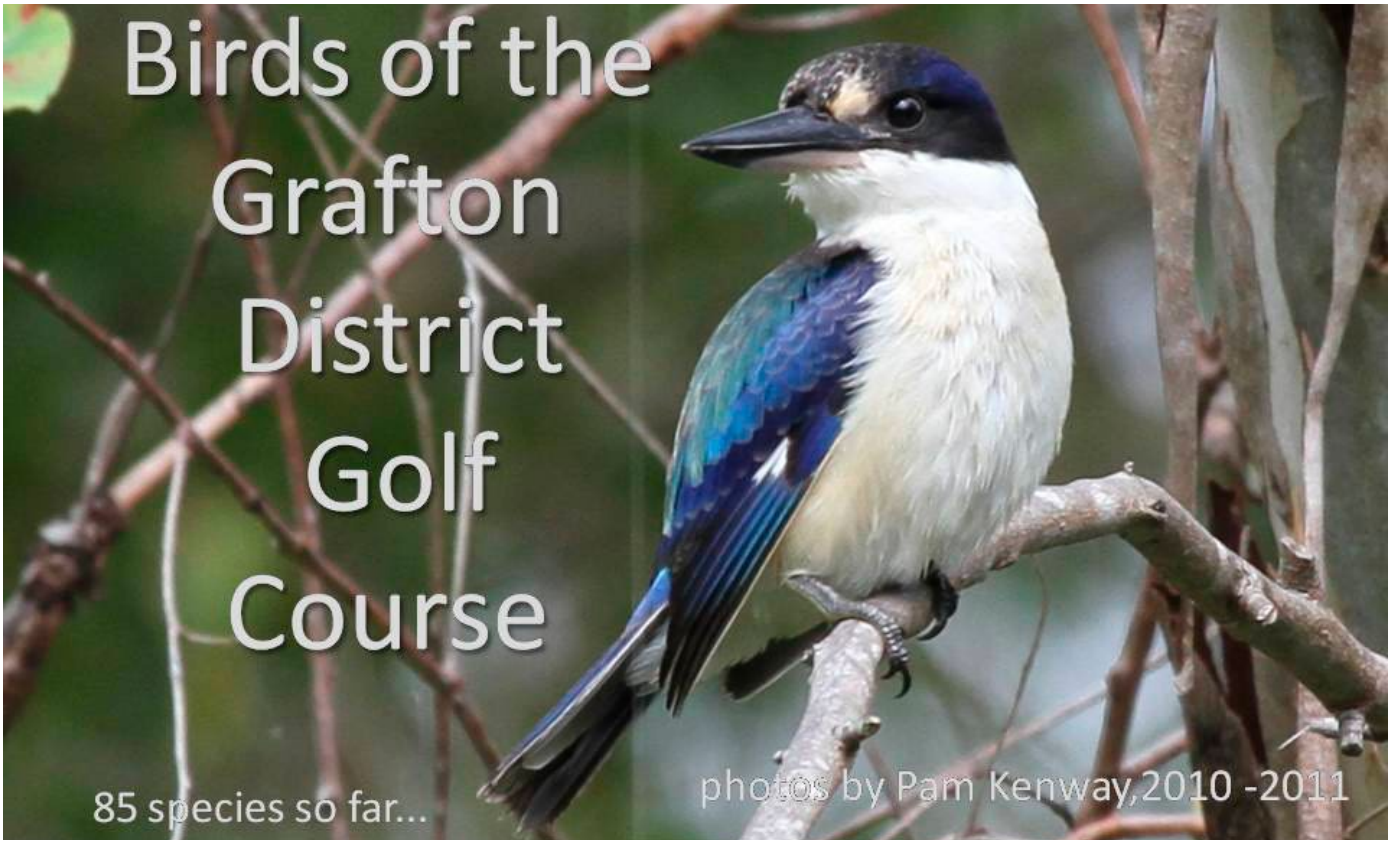

Over the last two years Pam Kenway has been photographing birds on the Grafton District Golf Course. With over 85 species recorded Pam believes the great diversity is largely due to the vision and push of Grafton golf course superintendent, John Nelson.Pam states "that for the last 30 years John has seen the club evolve from a fairly rocky, sparse course to today's picturesque, lush course in a bushland setting. As superintendent he has initiated regeneration of out of play areas, increasing their size and forming wildlife corridors with the nearby bush. With the help of the late Neil Farrington as greens president, a massive native tree and shrub-planting program was also instigated in the early 1990's. This, together with work to improve the health of the creeks and dams and their surrounds has encouraged the wildlife, in particular the native birds, onto the course.

The condition of the course is not only due to John and his team. Grafton has many volunteers who regularly give up their time to help with the gardening, mowing, filling of divots, pruning trees, collecting the garbage and many other tasks that arise in maintaining the course."

As a result, a DVD on 'The Birds of the Grafton District Golf Course" is now available. Anyone who is interested in purchasing one of these DVDs ($15 includes postage) should contact Pam on pam@cvcia.net.au or phone 02 66422682.

Phosphorus in the turf environment

Jim Hull – Independent Turfgrass Consulting

The issue of phosphorus in turf management is the subject of great scrutiny for several reasons, some agronomic, and some political.

1. Phosphorus is an essential element for all life, including the turf plants that we wish to grow
2. Phosphorus is an essential element for algae and weeds that turf managers definitely don't wish to grow
3. Many turfgrass facilities are in urban areas, therefore if you cause the local waterway to become a stinking mess you are likely to suffer much more scrutiny than if you cause a mess in a rural dam on your own farm
4. No-one needs to eat turfgrass to survive, and therefore turf is seen as an easy target for a clean-up. Solving the problem of algal outbreaks in lakes in dairy areas for instance is a much harder problem because many livelihoods and a major food source are involved.

Why is phosphorus such a problem?

The reason that phosphorus (P) is such a problem for turf management is that when P escapes to a surface water body it allows for the growth of green and blue-green algae and other undesirable aquatic organisms. These organisms can produce toxins, compete with desirable aquatic organisms, deplete the oxygen in the water, and change the aquatic environment by shading lower water layers

The level of phosphorus in solution required for the growth of blue-green algae can be as low as 0.03 ppm. In freshwater systems it is often phosphorus that is the limiting factor to the growth of algae and weeds, though some systems are limited by nitrogen (Foy, 2005). In marine environments it is normally nitrogen that is the limiting factor though again in some cases it may be P that performs this function. Cyanobacteria (blue-green algae) can fix nitrogen from the atmosphere and therefore only a lack of P can limit its growth. In most aquatic situations there is sufficient supply of potassium and other nutrients essential to the growth of algae, so these elements are not limiting to algal outbreaks.

The fact that there may be a level of P in soil that is excess to the requirements of turf growth is not normally in itself a problem if the P never moves from the soil to water. However, there are several pathways by which P can move from soil to water, and the turf manager needs to be aware of these, to take care to minimise this movement.

Is phosphorus toxicity an issue?

The scientific literature lists levels of P in plant material that are regarded as deficient, sufficient and excessive. The excessive levels cause damage to plant health and eventually death of the plant.

In normal circumstances phosphorus is taken up by plant roots and transported through the plant via xylem and phloem to growing tips of shoots and roots. The uptake is by means of proteins embedded in the cell membranes of plant root cells. Plant energy is required for this uptake and thus it is referred to as 'active' uptake as opposed to 'passive' uptake in which substances simply move into the plant in water that is being absorbed. Many plant species, including most commonly used turfgrass species, have evolved a process of regulation of P uptake whereby the number of uptake proteins is regulated by the supply of P available to the plant. The greater the supply, the fewer uptake proteins are produced by the plant. This limits the uptake of P and prevents the plant from accumulating toxic levels of P in plant tissue. Many Australian native plants have not evolved this feature, presumably because they exist in such low-P soils that they never needed to do so. These plants therefore will simply accumulate P in an unregulated fashion until they poison themselves. If those plants are being grown the supply of P must be regulated by limiting the amount of P in the soil by use of low-P or no-P fertilisers and by avoiding mulches or manures that will add excessive P to the soil.

The commonly grown turf species all seem to be able to regulate P uptake with the possible exception of fine fescue. Handreck and Black (2010) note that fine fescues "die out quickly as the phosphorus level increases". Handreck and Black also note that, while increased soil P levels may not be toxic to some native grass species, it can lead to them being out-competed by introduced species.

Where the scientific literature lists toxic levels of tissue-P in turf species it seems to result from experiments where the turfgrass plants are grown in a very low-P environment, and then are fed with a sudden surge of phosphorus.

How much phosphorus does the turf require?

This is the big question, because it has many answers. The tissue P content at which growth of the plant is not limited by lack of P can be fairly well defined by experiments in which samples of the plant are fed with graded amounts of P, the tissue is digested and then analysed for P content. The P-content per dry matter weight is determined and the point at which the plant grows at close to its maximum rate is then established. This has been done for most turf species and good information exists for sufficient tissue content for maintenance of turfgrass. Generally around 0.2 – 0.55% of dry mass is considered sufficient for healthy growth (Carrow et al. 2001), though Carrow et al. note that sufficiency ranges vary with "species, cultivar and growing conditions".

The soil P content for turf growth is not so easy to establish for a number of reasons. The amount of a nutrient that is actually available to a plant at any particular time, or over a period of time, is generally measured by extracting P

from the soil by shaking a sample in a solution designed to replicate in some way the plant's ability to access the nutrient. Some extraction procedures use weak extractants such as water or solutions of weak salts to estimate the amount of P currently available to the plant. Most extracting procedures used in turf and agriculture are designed to estimate the amount of P available to the plant in the medium term (ie. weeks to months). These procedures use extractants such as weak mineral acids, organic acids, alkalis, complexing agents and chelating agents.

As noted above, the extraction of soil P is designed to estimate the P that is available to the plant and in many situations the estimate may be a good one. Tests have been developed for specific situations where a particular fertiliser regime is followed. For instance, if wheat is grown in large areas of red, iron-rich soils and fed with superphosphate, then tests calibrated under those conditions can reliably predict the amount of P needed for future crops. Similarly, available P levels in natural soils can often be estimated by taking into account the pH and texture of those soils and by using the appropriate procedure. One of the confounding factors in turf soils is that all sorts of fertilisers get used in all sorts of soils. Extensive historical use of superphosphate on fairways has led to a large amount of residual calcium phosphates which can be extracted in relatively large amounts by acid extractants. Use of large amounts of soluble iron for cosmetic effects on the other hand leads to relatively insoluble iron phosphates in the soil, but these can be extracted in large amounts by alkaline test extractants (Hull, 2005). All this makes an accurate estimate of sufficiency levels of P for turf a bit problematic. The practical advice in this regard is that if the soil test result shows multiples of the recommended level of P present in the soil, then take it on faith that there is enough and don't add any more unless a plant deficiency is suspected (ie. the plant is showing deficiency symptoms). If the level of soil P is close to the recommended level, or a plant P deficiency is suspected then tissue testing will show whether the plant is getting enough P from the soil.

How can we restrict the movement of phosphorus?

The limiting of P movement to water is aided by an awareness of the possible pathways of movement. Phosphorus is relatively insoluble in most natural soils and will not leach through. This is due to the propensity of phosphate to bind to, or react with, many soil constituents such as iron, aluminium, calcium, magnesium and organic matter. Dissolved phosphorus can leach very rapidly through sandy soils due to the lack of significant amounts of the above-listed substances in those soils and P can also move through the sand as small particles of solid matter. Ozanne et al. (1961) recorded losses of up to 81% of applied fertiliser P through leaching in sandy soils.

Phosphorus can also end up in surface water through the movement of clippings, dirt particles and fertiliser. Dust blowing from bare ground, erosion by wind or water, movement of mud on machinery, leaves falling from trees,and washing down of fertiliser application equipment can all lead to phosphorus ending up in water bodies.

As noted earlier in this article the amount of P required to promote an algal outbreak in water is very small – around 0.03 ppm. For example, if we are talking about a water body of 20 megalitres, then the total amount of P in this water body required to exceed the critical level is 600 grams. A few kilograms of clippings being blown into the water, a bit of dirt eroded from the surrounding areas and a bit of overthrow from a fertiliser spinner can result in a major algal outbreak, causing enormous damage to the waterway (and possibly your turf management career).

The movement of phosphorus from turf soils to water can be limited by the following actions:

1. Only add P-fertiliser when testing indicates that it is required.
2. Never allow liquid or granular fertiliser to reach water bodies. Leave buffer zones around water bodies where possible.
3. Do not allow clippings to fly or wash into water bodies.
4. Limit silt movement from construction areas by using barriers.
5. Stabilise bare soil by keeping it damp, especially during windy conditions. Keep a solid cover of turf wherever possible.
6. Intercept drainage from sandy or P-saturated areas by directing drain output to nutrient stripping ponds, storage tanks or contained areas. Re-use nutrient-enriched water on the turf where possible.
7. Monitor sensitive water bodies to establish the sources of P pollution.

Phosphorus in water bodies can in favourable conditions be precipitated or fixed so that it is removed from the water at least temporarily. Phosphorus that reacts with clay, or is taken up by aquatic organisms can by buried in the silt on the bottom of the water body. Therefore nutrient stripping ponds are useful in lowering the P concentration in water, as is aeration of the water to promote microbial activity. At some point the system may become saturated with P, requiring harvesting of plant material or dredging of the water body. Phosphorus-binding substances such as aluminium sulphate (Alum) and lanthanum have also been used to 'lock up' dissolved P so that it settles out of the water.

Further reading

Very good information on phosphorus in the turf environment can be found in the following books:

Growing Media for Ornamental Plants and Turf, 4th Ed by Handreck and Black (2010)

Golf Course Management and Construction: Environmental Issues by Balcgh and Walker (1992)

Turfgrass Chemical and Fertility Problems: Assessment and Management by Carrow, Waddington and Rieke, (2001)

For a more in-depth treatment of phosphorus and the general environment see Phosphorus: Agriculture and the Environment – Agronomy No. 46 (2005) Sims, J. T. and Sharpley A. N. Eds. Published by the American Society of Agronomy

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drumMUSTER cracks 18 million!

National recycling program drumMUSTER has kicked yet another goal for the environment after recently collecting its 18 millionth chemical container.

This is a particularly special milestone for the service, which was first established in 1998 and collects empty ag vet containers and transforms them into practical items like agriculture pipes, wheelie bins and road signs. Incredibly, this initiative has now diverted over 23,000 tonnes of material from landfill.

When Goondiwindi farmer David Beare had more than 1200 of his and a neighbour's containers collected, little did he know just how significant the stockpile would prove to be.

"We built up a stockpile of around 1200 containers and we had someone come up and pick them up for us," he said.

"I've been using the program to get my drums crushed for the last decade or so and it's really helped me over the years. 18 million is a lot of drums, but I suppose it (bringing in the milestone container) could have been anyone!"

Thanks to the environmental commitment of drumMUSTER's wide array of users, the program is on track to safely dispose of over two million containers in the past year alone and the momentum shows no sign of stopping.

AgStewardship Australia Chief Executive Officer Karen Gomez has been following the progress of the industry stewardship program closely and she is extremely proud of the milestone.

"drumMUSTER is at the forefront of product stewardship around the world," Ms Gomez said.

"The progress it has made has been possible through the continued commitment of Australian farmers, agricultural chemical manufacturers and local government and they have certainly built a great Australian agricultural success story."

For any further information on the drumMUSTER program or to find your nearest collection site, call 1800 008 707 or log on to www.drummuster.com.au.

drumMUSTER

Environmental stewardship on New Zealand golf courses

by Will Bowden

Sports Surface Design & Management
SPECIALIST TURF CONSULTANCY SERVICES

There are more than 400 golf courses throughout New Zealand. This equates to the second highest number of courses per capita of any country in the world, (second only to the 'home' of golf – Scotland). These courses range from the archetypal "Kiwi country course" typically located in rural areas/holiday destinations often being inherently sustainable due to the with minimal resources available, and operating under a volunteer-based labour force. At the other end of the scale are the to the internationally known resorts of Cape Kidnappers (the only certified Audubon Cooperative Sanctuary golf course in New Zealand), Kinloch (the only Nicklaus designed course in New Zealand) and Kauri Cliffs.

The New Zealand golf sector is slowly becoming aware of the need to enhance its public perception in terms of its role regarding environmental stewardship. A contributing factor relating to this increased awareness has been the global recession, forcing clubs to review operating structures and implement more sustainable management strategies. There has also been a significant reduction in the number of people taking up the game in New Zealand over the past four years. Golf clubs are now being forced to look at how they utilise resources whilst ensuring they remain financially viable entities (one could argue "sustainable").

The New Zealand government recently provided a $300,000 grant to Project Litefoot from its Community Environment Fund (the CEF fund is made available to any community-based environmental initiatives throughout New Zealand). Project LiteFoot provides support and direction for sports facilities (in the case of golf clubs project liteclub) to practically implement a more sustainable approach to the management of their facilities. This initiative focussed primarily upon clubhouse operations However more recently the SSDM New Zealand Golf Course Sustainability Review now offers to expand this service to encompass the management of the golf course and wider natural landscape and enable the participating club to establish and develop a more holistic environmental management plan for the entire facility.

The major challenge in New Zealand has been encouraging clubs to take a proactive approach to environmental management. With some notable exceptions, many of the country's golf courses still regard investing in a review and action plan to address the environmental issues relating to their course as an unnecessary or unjustifiable expense. However in relative terms investing in an environmental management plan (EMP) or Sustainability Review now, may offer solutions and suggestions to save money and resources in the mid to long-term, as well as 'future proofing' the club in terms of likely future environmental legislation.

There are a number of key issues affecting the environmental management of golf course in New Zealand today, including: (see table below)

Table1. Some factors limiting the environmnetal awareness and performance of New Zealand golf courses, with suggested solutions.

Limiting factor	ISSUE	SOLUTION
Industry perception	A general negative perception of ecological issues across the golf course sector. This area is not viewed as a priority within many New Zealand golf clubs.	Enhance the value and necessity for New Zealand golf courses to have a local and specifically designed and implemented environmental resource available to them.
Lack of consistent legislation	There are inconsistencies relating to environmental legislation across New Zealand. Local legislation varies considerably resulting in an inconsistent platform from which to standardise and legislate environmental best practice across the country.	Review of the regional and national environmental legislation. A more standardised approach to environmental law.
Lack of available resources	Many clubs in New Zealand are struggling to wash the clubroom windows, let alone invest in a review of their sustainability.	Encourage the establishment and development of local projects such as, *Project litefoot* and the *SSDM New Zealand Golf Course Sustainability Review.*
Limited profile	Limited profile regarding the importance of ecological management for New Zealand golf courses. The focus of workshops and education has historically been on agronomic and/or operational issues.	Incorporate a greater emphasis on ecological issues at the most fundamental level of training within the turf sector. Enhance the profile of accreditation schemes across New Zealand, currently only one golf course out of 400 with a recognised form of environmental accreditation.

The following overseas environmental certification programmes are currently available to New Zealand golf courses

Table 2. Description of current international initiatives available to New Zealand golf courses

Programme	year established	country	key features	number of NZ golf courses certified	cost
Golf Environment Organisation (GEO)	2009	UK	• Non-profit • Web-based support • Global network of associates • Growing international reputation and acknowledgement	None	Free
e-Par	2007	AUS	• Commercial company • Web-based support • Focus on Health and Safety and Risk Management • International agents • Reputation largely restricted to Pacific/Oceania region	None	Not known
Audubon Sanctuary Programme	1987	USA	• Commercial organisation • Web-based resources and guidance • Holistic approach to the management of the entire facility • Well-established international reputation	one	Variable
International Golf & Life Foundation (IGOLF)	2007	SWITZERLAND	• Non-profit • Web-based resources • Limited 'field' guidance • Limited international reputation	None	Free

Case Study
Muriwai Golf Club

Muriwai golf course is a 'links' course situated on the west coast of the North Island, 42 km north west of Auckland and was constructed out of the native Muriwai black sand dunes in 1956.

The course is bordered by the Tasman sea to the west and Department of Conservation (DOC) managed land to the east. The turf composition of the course typifies a New Zealand golf course, with Kikuyu grass dominating from tee to green. Where Muriwai differs from many of the courses in New Zealand is in regards to the management of the greens. These are currently a mixture of native browntop bent grass and poa annua.

One of the primary objectives for golf course superintendent Frank Redman is to convert these surfaces to a 'pure' browntop sward. This process is well underway with Frank implementing an austere approach to the management of the greens in order to encourage the browntop back into sward dominnace.

As Frank encapsulates the philosophy at Muriwai as:

"As far as possible follow traditional greenkeeping methods. To be ecologically sound and environmentally aware, protecting the future of golf for all".

About the author:

Will Bowden is a Sports Turf Consultant for Sports Surface Design and Management (SSDM), a New Zealand based sports turf consultancy. As part of this role within the SSDM team, he has developed a comprehensive range of services dedicated to assisting golf course superintendents in the sustainable management of golf courses throughout New Zealand and overseas.

One such service is the establishment of The SSDM New Zealand Golf Course Sustainability Review. This unique initiative has been developed with the involvement of New Zealand Forest and Bird and provides an objective means of reviewing the current sustainability and environmental management of a golf course.

The review enables the club to establish realistic and specific targets that can be monitored with additional on-going support over the next 12 months. After one year of the programme a second review is carried out and a comparative score is made. The club then has objective data from which to monitor various factors such as appropriate use of resources, efficiency of operations and environmental stewardship etc. SSDM will also investigate and apply for any appropriate environmental funding opportunities on behalf of the golf club.

A measure of improvement

Table 3.. Benchmarks relating to selected critical factors of sustainable course management at Muriwai

surface/area	five years ago	present day	reasons for improvement
Organic matter levels (greens)	Upto 12% in top 0-20mm	5% in top 0-20 mm	Low inputs and regular, intensive renovation over the past 3 years. Now one intensive renovation per year, followed by a regular sanding programme
% poa annua in sward	Up to 80%	30-35%	Improved rootzone and nutrient input
% browntop in sward	5-10%	50%	Over sowing at renovation
Fungicide applications/year	17-20	12-14	Improved rootzone, plant diversity and efficient watering
Kg N per year applied to greens	250 kg +	171 kg	Increase plant diversity

Muriwai was the first course to be piloted by the SSDM New Zealand Golf Course Sustainability Review.

The course scored 72% out of a possible 82% on the initial review. With the help of some additional funding it is hoped that over the coming 12-18 months specific projects shall commence relating to the enhancement of the course environmental stewardship and value, as well as its operational sustainability. One specific area the course are keen to develop is the volume of native planting throughout the site. This is already carried out by members and volunteers and has been beneficial in increasing the stability of adjacent dune systems as well as inter-connecting surrounding habitat 'islands'

Fig 2. Areas of inter-linking native plantings, creating a network of corridors for wildlife at Muriwai GC, Auckland - NZ

Conclusions

New Zealand markets itself to the world as "100% pure" and "Clean and green". However there is a requirement for a deeper investment with regards to environmental stewardship than merely a glossy promotional campaign and images of an unspolit natural landscape.

In terms of its golf courses there is likely to be an increasing pressure placed upon the industry to deliver assurances and evidence that the country's golf courses are being maintained in a responsible and sustainable manner. As environmental pressure and legislation on the production industries and wider community tightens, this will be reflected by a need for the amenity and leisure industry to comply. For the time being applied environmental management remains an initiative of the proactive. However studying the model of Europe and nearby Australia would indicate that in the future it will become a more prescribed initiative.

E-par UPDATE

WASH BAYS AND ENVIRONMENTAL RESPONSIBILITY

By Terry Muir 2006

In May 2006 I wrote an article for the AGCSA concerning wash bays. That was five years ago and in that time the industry has experienced dramatic change in technology, innovation, best practice and the environmental and safety requirements. E-par has dedicated that four years embracing industry feedback and researching the evolving area of wash bays and waste water management. It is therefore appropriate and timely that I provide an update of the 2006 article.

As a result of this update the conclusions or implications of the 2006 publication are now superseded by this report. The following is the update of the 2006 article.

1. Introduction

The nature of the environmental incident at Warringah was a simple procedural matter relating to the wash down area of the golf course. Put simply, the lack of proper facilities, the lack of an emergency plan in the event of a spill and lack of staff training contributed to the offence. This finding has placed golf and sports turf industries on notice and many golf clubs are currently experiencing increased regulatory scrutiny regarding their wash down operations.

The wash bay area of a golf club is where pesticide application equipment, mowers and other pieces of equipment are washed. This is where pollution of soil, surface water or ground water is most likely to occur on a golf course unless appropriate systems are in place. Wash water generated from the cleaning of equipment can contain suspended solids, nutrients, coarse sediment, oil and grease, bacteria and heavy metals. Contamination of soil and water can occur unless appropriate infrastructure and procedures are in place. Recently there is evidence

confirming the presence of dangerous levels of bacteria in wash down water and waste water produced during water treatment processes.

2. Corporate Governance

Wash down bays are fraught with risk and everyone in the industry knows it. Responsibility of installing the "right" solution rests clearly with club management and the words of Justice Talbot when handing down the sentences in the Warringah case should still be ringing in everyone's ears. Scathing of the industry and club management, Justice Talbot said, "The Court should send a powerful message to sporting club operators, and in particular, golf clubs, that mismanagement or, particularly as in this case, abandonment of environmental responsibility will lead to condign punishment." He went on to state, "The club, through its board and management, never seriously addressed the issue of environmental responsibility."

It is a fundamental principle of good governance for wash bay design and management to have in place facilities, practices and processes that address environmental management, occupational health and safety and welfare of employees using the facilities. Today, wash bay compliance involves a greater number of statutes, regulations, industry standards and principles than ever before. Society is becoming more litigious and regulators are having their arsenal bolstered by greater powers and a greater range of penalties.

Whilst the wash bay area occupies an insignificant portion of the catchment of any golf course, this small parcel of work space has the potential to seriously expose a club's due diligence failings.

3. Planning a Wash bay

Get an expert. If you already have a wash bay or are considering a new wash bay, you must also consider the use, storage and handling of hazardous and dangerous goods which brings into play the physical properties of chemical substances, like flammability or corrosiveness and their compatibility with each other. You must also consider how employees should safely handle waste water and operate within the wash bay in the course of their work and of course you must consider how employees using a wash bay are going to protect the environment.

Unfortunately there are limited definitive guidelines for the selection and design of an appropriate wash bay. Important issues related to the performance criteria, system layout, appropriate size, bunding, system efficiency, maintenance and management are buried in detailed Standards and guidelines with the regulatory bodies providing only cursory information. Wong et al (2001) referred to a "treatment train approach" in which a pollutant trap is just one component of a wastewater management program. The treatment train approach for a golf course wash bay would need to consider:-

- Wash bay location and layout
- Designed flows
- Trapping efficiency
- Pollutant loads
- Dimensions of structure
- Energy efficiency
- Management protocols
- Maintenance protocols and efficiency
- Cost benefit analysis
- Use town water or roof top water
- Use of recycled water
- Procedures and training
- Legislative requirements

All of these factors of course contribute to the capital cost of the wash bay and the on-going maintenance of the wash bay. The wash bay is a high risk area and the costs and benefits of having an appropriate system in place should be evaluated by club management in the same way and according to the same criteria as any other decision about business process management at the club.

3.1 What is required?

A designated area to contain and collect any waste water concentrates or other substances associated with wash down. The area must be constructed of impermeable material that contains and retains any wastewater or spill. It must comply with regulations for protecting the environment, employee safety and in the handling and storage of dangerous goods and hazardous materials.

3.2 What disposal options are there for waste water?

3.2.1 Re-use the wash down water

Reuse of the treated wash down water was once the preferred option as many believed the reuse of water was a significant water saving and money saving option. It is not. If the wash bay is designed appropriately a machine wash should take about 7 minutes and use about 50 litres of water. This water can be captured for very low cost from a tank capturing rooftop stormwater or it can cost about $2 per week using town water. Spending a lot of money on energy and bio remedial materials doesn't make a lot of sense to save a small amount of water.

Of course the reuse of waste water should form part of a club's wash bay considerations. If so they must also consider the potential occupational health and safety issues associated with water reuse. To best manage waste water reuse you must implement OHS planning and management regimes along with a robust program of water testing to ensure staff are not being exposed to polluted water coming from the nozzle of the treatment system. Recent tests from some sumps and from the nozzle delivering the reused water for wash down should send alarms throughout the industry. THE MESSAGE HERE IS - IF YOU ARE USING RECYCLED WATER IN WASHDOWN IMPLEMENT A

WATER TESTING REGIME NOW. You need to ensure you are not exposing staff to potentially dangerous bacteria.

3.2.2 Discharge to sewer

This is the preferred option for waste water discharge because it ticks all the boxes – it is economical, energy efficient, operationally efficient, safe, and poses minimal risk to the environment. Governments have devoted significant expenditure in the design, management and maintenance of municipal waste water treatment plants. They offer industry the opportunity to take advantage of this investment by providing permits to discharge wash down water to sewer if it meets certain criteria for about $150.00 yr. This is a low cost and low risk option. The benefits include low cost, reduced risk of staff becoming exposed to contaminants in recycled waste water and reduced risk of environment spills.

3.2.3 Discharge of waste water to an on-site pit or irrigate gardens/landscaping

There are some clubs that do not have access to sewer. The discharge of waste water from wash down may, under certain circumstances, be directed to gardens or seepage pits, provided that they meet specific water quality standards. To do so requires detailed and careful planning and negotiation with regulatory bodies.

3.2.3 What about the sludge

All waste water treatment plants will create sludge or waste material of some description. They are not completely closed loop systems. The answer here is very straightforward. The sludge from any waste water treatment plant must be collected, stored safely and appropriately disposed of. It cannot be disposed of to land without a permit. This costs money so the less sludge the better.

3.2.4 Does the wash bay require bunding?

A raised edge or lip is required to contain the wash water. A lipped edge (speed hump) will allow access of vehicles to the wash bay. The level of sophistication of the containment that might be required of a bund depends on the level of risk posed to the environment from each facility. This would be based on a number of site-specific factors, including: the constituents of the waste water and its potential impact on the environment; the amount of liquid being used or stored and the ability of the facility to prevent spillages or leakages, and hence the risk of a spill or leak occurring; the duration of any temporary storage; the sensitivity of the receiving environment.

3.2.5 Will the wash bay require Council approval?

Yes. Generally the local council's planning provisions may require consent. It is good practice to liaise with your local council. Don't be fooled into thinking a DA consent from council for your wash bay means that your facility is compliant with all legislation. There are compliance issues associated with dangerous goods legislation and regulations, safety legislation and environmental issues that a council consent will not cover. For peace of mind you should request from any builder or designer of your wash bay compliance certificates in environment, safety, engineering and Hazardous Materials and Dangerous Goods.

3.2.6 Can I mix chemicals in the wash bay?

You can under certain conditions. This will require a detailed review of the chemicals in use and a plan to ensure conformance with the dangerous goods and hazardous materials legislation. You will require expert advice here.

4. Conclusion

Any wash bay will require consideration of the proposed pollutant load, containment options, treatment options, disposal options and environmental and safety goals against capital and maintenance costs. A thorough cost benefit analysis should be conducted to determine economic and social payback. Analysis will include frequency of use, utilities cost, energy, maintenance and disposal or discharge rates.

The wash bay area at any golf club is perhaps the most significant source of pollutant constituents in golf course maintenance operations. Other maintenance area activities such as the storage of fuels and the mixing and loading of chemicals simply contribute to the high environmental risks associated with operating a maintenance area.

The Warringah case has clearly demonstrated that golf club management decision making must include a precaution based approach focusing not only upon potential hazards but also on hazards already known to exist at the club. Many clubs do not have appropriate wash bays and containment areas. Importantly in the Warringah case, the EPA submitted that had the spill been contained on-site no environmental harm would have occurred or would have been likely to occur. Your club does not want to be the next club to negligently contribute to an environmental offence by not managing its wash bay operations.

Terry Muir M. Sc & Tech (Env SC), B.App.Sc (EAM), Env Auditor, Cert IV
1 June 2011

HOW DOES YOUR CLUBS ENVRIONMENTAL STATUS RATE?

Answer the questionaire below for a snapshot of your clubs current due diligence status

E-PAR ENVIRONMENTAL DUE DILIGENCE DIAGNOSTIC QUESTIONNAIRE

Club Name: Insert Club Name **Date**

No.	ANSWER THE QUESTIONS FOR A SNAPSHOT OF YOUR CURRENT DUE DILIGENCE STATUS	Response
GENERAL:		
1	Have staff received environmental awareness and responsibility training?	
2	Have all staff received environmental induction?	
3	Has the General Manager received environmental awareness and responsibility training?	
4	Have you documented evidence that senior management have taken all reasonable steps to ensure staff understand their environmental obligations?	
5	Is environmental excellence documented as a key corporate value of the club?	
EMERGENCY PLANNING:		
6	Do you have a documented procedure setting out what to do in the event of a spill? (fuel and chemical)	
7	Have you conducted a simulated environmental emergency exercise in the past 12 months?	
8	Do you have an environmental risk register that identifies activities that have a significant impact on the environment?	
9	Are the resources required in the event of an environmental emergency regularly reviewed? (spill kits, first aid, communications etc)	
10	In the event of a spill during fuel dispensing can you contain all products on site from entering the environment?	
SENIOR MANAGEMENT:		
11	Has club management put in place an environmental management system or plan?	
12	Has management issued a formal, written statement or environmental policy?	
13	Are managers familiar with the day to day activities on site that can impact upon the environment?	
14	Has senior management provided a budget for environmental management and environmental training?	
15	Does management monitor the environmental performance of staff?	
ENVIRONMENTAL ADMINISTRATION:		
16	Has an environmental risk assessment been conducted in the last 12 months?	
17	Has an environmental audit been conducted in the last 24 months?	
18	Do you have a legal register of the environmental legislation to which your organisation must comply?	
19	Are environmental duties and responsibility included in job position descriptions?	
20	Can senior management provide evidence that they have individually taken action to manage the environment? Minutes, memos etc.	
DOCUMENTATION:		
21	Do you have documented procedures in place (Standard Operating Procedures) for activities that can impact on the environment?(fuel dispensing, chemical mixing, rinsate disposal, spray drift, fuel and chemical delivery, incident reporting, waterways protection, washing of plant and equipment, fuel tank inspections etc)	
22	Do you maintain a register of environmental training?	
23	Do you maintain an environmental incidents register?	
24	Do you have an Environmental Induction Handbook?	
25	Do you have an environmental incident reporting process in place as part of an EMS?	

INFRASTRUCTURE:		
26	Do you have a dedicated compliant wash bay and waste water treatment system?	
27	Do you have appropriate bunding in your chemical storage area?	
28	Do you have bunding in your chemical mixing area capable of holding the contents of your biggest spray tank?	
29	Does your workshop store flammable products in appropriate dangerous goods cupboards?	
30	Is fuel dispensing undertaken in an appropriately contained and hardstand area?	
DUE DILIGENCE:		
31	Is there documented evidence that the organisation could produce to demonstrate that they had taken all reasonable measures to protect the environment?	
32	Is management aware of their legislated environmental "duty of care?"	
33	Does management understand that they can be held personally liable for en environmental pollution event caused by a staff member or contractor?	
34	In there a process in place to track and report on environmental performance?	
35	Are there documented environmental improvement goals in place to address compliance?	
RESULTS - Less than 50% green - facility is carrying significant individual and corporate environmental risk and liability		

AGEF SUPPORTER PACKAGES

The Australian Golf Environment Foundation (AGEF) has a range of supporter packages to suit corporate, club and individuals that may wish to contribute to fostering future research and knowledge into golf and the environment. For more information on how to become involved with the AGEF, contact John Geary at the AGCSA on (03) 9548 8600 or email jgeary@agcsa.com.au

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